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AUTHOR Ellis, Susanne D.
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ABSTRACT

Results of the 1981-1982 Graduate Student Survey of physics and astronomy graduates in the United States are presented. Information is provided on the educational background, current graduate student status, choice of subfield, and employment prospects where applicable. Highlights include the following: a further increase occurred in the number and proportion of foreign graduate physics students; for physics masters, there were more degree recipients, an improved employment outlook, and the largest annual salary increase for 1982 graduates; and an increase occurred in the proportion of doctorate recipients who accepted tenurable university positions. Information is included on the following student characteristics for the total graduate population and separately for minority group students: sex, citizenship, professional society membership, major of bachelor's degree, type of bachelor's institution, type of graduate institution, full- or part-time attendance, and sources of financial support. Additional tables include: number of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed, and type of employers and work activity of 1981-1982 physics master's degree recipients. (SW)

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AIP REPORT - Manpower Statistics Division

American Institute of Physics
335 East 45 Street
New York, N.Y. 10017 (212) 661-9404

1981-82

GRADUATE STUDENT SURVEY

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by Susanne D. Ellis

AIP Pub. No. R-207.15 May 1983

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AIP report
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1981–82
GRADUATE STUDENT SURVEY

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As the nature of graduate education changes, it seems appropriate to look for, and call attention to corresponding changes in graduate student populations. The Graduate Student Survey was designed to address such changes and has been conducted annually for over twenty years. Up until eight years ago it included only physics students, but in 1974 astronomy students were added to the survey. Each student is requested to contribute information on his or her educational background, current graduate student status, choice of subfield, and employment prospects where applicable. The highlights of this year's report are:

- → a further increase in the number and proportion of foreign graduate physics students
- → overall gains reported by physics masters: more degree recipients, an improved employment outlook, and among the physics degree recipients of 1982, the largest annual starting salary increase
- → an increase in the proportion of doctorate recipients who accepted tenurable university positions.

Information on the demand for new physics graduates is a frequent request. In this annual survey demand, a complex concept, is roughly measured by the number of employment offers each degree recipient receives. **Figures I** and **II** present the percentages of doctorate recipients and terminal masters who received no offers, one offer and multiple employment offers respectively. Looking at the most recent five-year period, the most conspicuous change occurred for the new masters of the class of 1982. A record-high proportion of masters accepted their first employment offers, which generally points to uncertainty on their part about receiving additional offers for comparison. A 13 percentage-point increase over the previous year resulted in acceptance of first offers by 60% of the new masters; a corresponding decrease in masters with multiple offers is shown in **Figure II**. The proportion without immediate offers also declined somewhat. The demand for doctorate recipients tends to show only small annual changes, and the class of 1982 is no exception. New doctors without immediate employment offers rose from 3% to 5% as those with multiple offers declined correspondingly.

Fig. I. Employment offers for new physics doctorate recipients, 1977–82

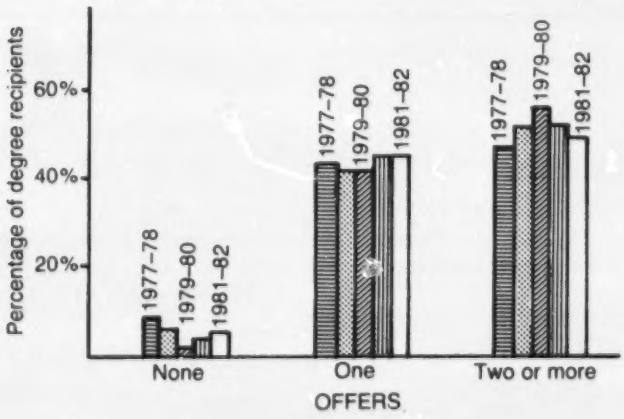


Fig. II. Employment offers for new physics masters 1977–82

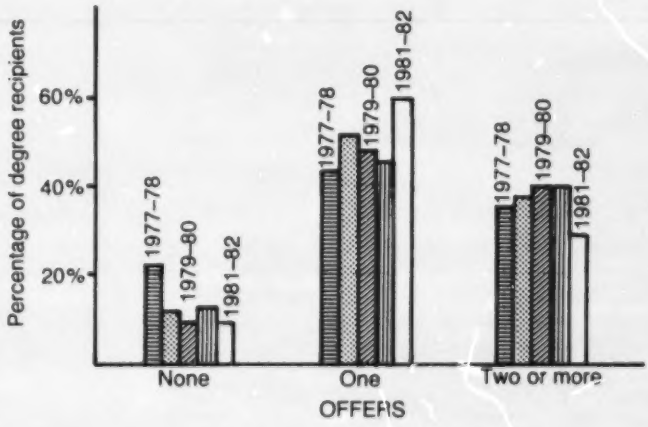


Table I. Characteristics of the graduate physics student population, 1981–82.

Characteristics		All graduate students	First-year graduate students	Degree recipients: Terminal masters	Degree recipients: Doctorate recipients
	*Total population:	10 173	2630	637	912
	Number of respondents:	6 496	1387	247	561
Sex	Female	10%	10%	13%	7%
	Male	90	90	87	93
Citizenship	U.S.	69%	63%	85%	76%
	Foreign	31	37	15	24
Professional society membership	Yes	28%	12%	13%	54
	No	56	72	65	32
	No response	16	16	22	14
Major of bachelor's degree	Physics	88%	86%	88%	92%
	Mathematics	3	3	3	3
	Engineering	4	5	3	2
	Other	5	6	6	3
Type of bachelor's institution	PhD-granting	48%	43%	44%	54%
	MS-granting	8	9	15	5
	BS/BA granting	18	16	26	20
	Foreign	26	32	15	21
*Type of graduate institution	PhD-granting	91%	86%	78%	100%
	MS-granting	9	14	22	–
*Student status	Full-time	89%	89%	80%	90%
	Part-time	11	11	20	10
Source of support	Teaching assistantship	36%	55%	41%	16%
	Research assistantship	42	14	21	56
	Fellowship	9	11	7	10
	Employment	9	13	24	14
	Family, savings, loan	2	4	4	2
	Other	2	3	3	2

**These data were derived from the Survey of Enrollments and Degrees.*

Of the eight characteristics presented in **Table I**, citizenship is the one which indicates the greatest changes each year due to the continuing influx of foreign physics students to U.S. universities. For example, both first-year and all foreign graduate students showed a four percentage-point increase over the previous year. The proportion of women among all graduate students remained constant, while female doctorate recipients reflect a one percentage-point increase in the most recent year.

Membership in a professional society is a relatively new question put to graduate students, and as expected, a majority of doctoral graduates are members, while very few (12%) of the first-year students, or (13%) of the terminal masters had joined a professional society.

At the graduate level, the influx into physics from other disciplines remains small; the characteristic labeled "Major of bachelor's degree" substantiates this statement by offering details. Also, there is little change from the previous year in the high proportion of graduate physics students who study on a full-time basis, nor are there significant changes in the students' sources of financial support.

The total number of survey respondents who identify themselves as members of a specific minority group is over 1700, or 26% of all respondents. It is important to note that most of these students are foreign citizens. **Table II** presents six characteristics of six minority groups and divides the larger groups on the basis of citizenship. The numbers of degree recipients, with the exception of blacks, should be treated as lower limits because they represent individual respondents to a survey which has an overall 64% response. Black degree recipients, on the other hand, are also reported by physics department chairmen in the Survey of Enrollments and Degrees which undoubtedly improves the accuracy of those totals.

Women comprise 10% of all graduate physics students; however, Asian Indians and Orientals indicate larger proportions of women, while Arabs include a considerably smaller proportion. Another characteristic in which minority groups differ from the graduate physics student population as a whole is study status. Of all graduate physics students 11% study on a part-time basis. However, 17% of the U.S. minority groups are part-time students, but only 4% of the foreign minority students fall into that category.

Table II. Characteristics of minority group physics students, 1981–82.

Characteristics		Black U.S.	Black Foreign	American Indian	Hispanic Puerto Rican	Hispanic Mexican American	Hispanic Other U.S.	Hispanic Other Foreign	Asian Indian	Oriental U.S.	Oriental Foreign	Arab
	Total number:	63	34	12	18	19	7	124	379	95	736	217
Sex	Female	5	4	2	1	1	–	13	61	12	105	13
	Male	58	30	10	17	18	7	111	318	83	631	204
Degree status	TMS	13	5	2	4	4	2	11	20	8	49	17
	MS and PhD	42	26	9	10	12	4	80	297	65	425	157
	PhD only	8	3	1	4	3	1	33	62	22	262	43
Student status	Full-time	46	31	9	14	15	6	120	369	87	704	201
	Part-time	17	3	3	4	4	1	4	10	8	32	16
Prof'l society membership	APS	14	3	2	1	3	2	22	67	24	93	29
	Other society	2	1	1	1	1	–	8	1	5	16	6
	No answer	47	30	9	16	15	5	94	311	66	627	182
Full-time equivalent years of graduate study	≤1	11	12	3	7	4	1	21	66	18	182	44
	2	17	12	1	5	5	1	24	75	19	135	38
	3	6	2	4	3	4	3	16	64	12	115	42
	4	8	2	–	1	3	1	26	48	15	97	32
	5	8	2	1	2	2	1	22	54	14	112	25
	≥6	13	4	3	–	1	–	15	72	17	95	36
Major subfields	Elem. particles	8	–	4	1	3	1	12	36	10	85	26
	Nuclear	3	7	–	1	–	1	10	38	4	56	27
	Optics	6	1	–	–	1	1	4	12	2	38	8
	Plasmas	1	2	–	–	2	–	6	6	11	33	8
	Solid state	15	10	2	9	1	–	42	147	28	278	77
Graduate degree recipients	TMS	9	3	1	0	1	1	3	11	6	18	13
	Doctorates	11	5	1	1	1	0	15	36	13	51	14

The data in **Table III** were scaled up to reflect the total number of graduate physics students in each of the major subfields and at nine levels of graduate study. One reason for presenting this type of analysis is to make it possible to estimate the number of graduates in a given subfield who will seek employment within a year or two. The median number of years of graduate study spent to complete a physics doctorate is between five and six.

A noteworthy change in the distribution of subfields is the increase in mathematical physics students; this change is probably attributable to the increase in foreign students. Although not shown in this report, foreign students tend to be theoreticians, and mathematical physics is basically a theoretical subfield.

Table III. Number of graduate physics students, by subfield and years of graduate study completed, 1981–82.

		Full-time equivalent years of graduate study ≤1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	>9 yrs.	Total graduate students N	%
Distribution* of students	N	2637	1943	1505	1282	1221	824	386	213	162	10 173**	
	%	25.9	19.1	14.8	12.6	12.0	8.1	3.8	2.1	1.6		100%
Astrophysics		105	89	69	75	66	37	22	20	8	488	4.8
Biophysics/radiology		127	82	32	39	29	30	12	8	7	366	3.6
Electron, atomic, molecular		142	96	128	114	102	94	48	16	23	763	7.5
Elem. particles		256	184	209	168	182	107	43	33	18	1 200	11.8
Math. physics		240	169	99	94	71	40	6	5	8	732	7.2
Nuclear physics		176	148	128	139	126	69	33	18	7	844	8.3
Optics		146	108	80	65	48	40	13	3	6	509	5.0
Plasma physics		93	78	96	73	83	60	28	20	18	549	5.4
Solid state		636	533	490	402	407	275	144	75	49	3 011	29.6
Engineering and applied physics		187	180	34	21	30	16	5	5	–	478	4.7
Other subfields		529	276	140	92	77	56	32	10	18	1 233	12.1

* The distribution of students in each subfield is based on 6199 respondents to this question.
**The total was derived from the Survey of Enrollments and Degrees.

Table IV. Sources of support for graduate physics students, by sex and degree status, 1981–82.

Source of support		Female	Male	Candidates for: Terminal master's	Master's enroute to PhD	PhD after master's	PhD only	Total N	Total %
Teaching assistantship		39%	34%	39%	45%	26%	35%	2202	34%
Research assistantship		37	41	16	29	53	46	2735	42
Fellowship		9	9	4	8	8	12	572	9
Employment		9	9	28	9	7	3	578	9
Family, savings, loan		3	2	6	3	1	1	156	2
Other		1	4	5	4	4	2	156	2
Multiple sources of support, primarily with teaching assistantships		2	1	2	2	1	1	97	2
		100%	100%	100%	100%	100%	100%		
Total respondents	N	675	5821	743	1319	2745	1689	6496	
	%	10	90	12	20	42	26		100%

Sources of support for graduate students are primarily influenced by a student's candidacy for a specific degree and less by the sex of a graduate student. In **Table IV** we find that off-campus employment is far more prevalent among terminal master's degree candidates than in any other group of degree candidates, and since women are more likely to be terminal master's degree candidates than doctoral candidates, a higher proportion of them are offered teaching assistantships than the more desirable research assistantships. Using family funds or student loans as sources of support continues to be reported by very few graduate students in physics.

The normal pattern of graduate education in physics constitutes two years of course work followed by three or four years of research in an area of concentration which leads to a doctoral dissertation. The intensive professional work, which usually starts in the third year of graduate school, is performed either on an experimental or theoretical basis. An array of doctoral candidates, grouped by type of research, subfield and level of graduate study, is presented in **Table V**. The ratio of experimentalists to theoreticians is approximately 2:1, and none of the subfields reflects a major change in the proportion of students it attracts.

Table V. Number* of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed, 1981–82.

Physics subfield	Type of research	Full-time equivalent years of graduate study: 3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	>9 yrs.	N	Total % Exp.	Total % Theo.
Astrophysics	experimental	39	62	58	19	10	12	10	210	5.4%	
	theoretical	28	24	12	22	8	8	–	102		6.0
Biophysics	experimental	23	31	37	25	8	4	4	132	3.4	
Electron, atomic molecular	experimental	97	103	85	74	39	12	19	429	11.0	
	theoretical	26	20	16	16	6	5	4	94		5.5
Elem. particles	experimental	95	101	130	64	37	21	6	454	11.7	
	theoretical	94	79	61	28	12	10	10	294		17.3
Math. physics	theoretical	116	92	77	41	4	6	8	344		20.3
Nuclear	experimental	95	101	99	58	27	10	4	394	10.1	
	theoretical	24	37	28	12	12	8	4	125		7.4
Optics	experimental	66	47	43	31	2	4	6	199	5.1	
Plasmas	experimental	43	31	47	23	14	8	10	176	4.5	
	theoretical	39	28	22	18	4	6	4	121		7.1
Solid state	experimental	396	289	332	227	120	52	41	1457	37.4	
	theoretical	116	83	90	39	18	8	10	364		21.5
Other subfields	experimental	139	81	60	81	29	35	20	445	11.4	
	theoretical	69	73	24	46	36	3	2	253		14.9
Total	experimental	993	846	891	602	286	158	120	3896	100.0%	
	theoretical	512	436	330	222	100	55	42	1697		100.0%

*The numbers in this table have been scaled up to reflect the total number of graduate students (5593) who completed three or more years of graduate study.

Table VI. Distribution, by subfield and employment offers for doctorate recipients, 1981–82

Physics subfield		Total in subfield	Employment-oriented graduates	New 'postdocs'	Percentage of graduates within subfield received: 0 offer	1 offer	>2 offers
Astrophysics		4.5%	1.2%	3.3%	–	55%	45%
Biophysics/radiology		3.3	1.5	1.8	–	47	53
Electron, atomic, molecular		11.5	7.3	4.2	4%	50	46
Elem. particles		11.8	4.5	7.3	6	52	42
Math. physics		5.4	2.9	2.5	3	36	61
Nuclear physics		9.2	4.3	4.9	11	35	54
Optics		4.5	3.7	0.8	4	27	69
Plasmas/fluids		7.2	5.6	1.6	3	44	53
Solid state		34.1	20.8	13.3	7	43	50
All other subfields		8.5	4.6	3.9	4	55	41
Total	%	100.0%	56.4%	43.6%	5%	45%	55%
	N	891*					
All experimental subfields			356	248	4%	44%	52%
All theoretical subfields			145	142	7%	46%	47%

*This total does not include an estimated 21 graduates who were not interested in immediate employment, (see Figure IV). It is the Survey of Enrollments and Degrees which supplied this total.

Degree recipients

Taking into account the degree of specialization doctoral graduates acquire, it is not surprising that employment opportunities are more meaningful when expressed in terms of physics subfields and types of research. **Table VI** takes the doctorate recipients who are interested in immediate employment, shows their distribution by subfield, and distinguishes between two types of initial employment: postdoctoral fellowships or potentially permanent positions. For each of nine major subfields **Table VI** shows the percentages of graduates who received employment offers. Though not a large subfield, optics graduates have the highest percentage of multiple employment offers in 1982, and one of the highest percentages during the previous two years.

The lower portion of **Table VI** shows that 44% of all the employment-oriented doctoral graduates of 1981–82 accepted 'postdocs' which represents a five percentage-point increase over the previous year. Examining the group of degree recipients without immediate employment offers, we find that only 4% of the experimentalists, but 7% of the theoreticians constitute those 5% still seeking offers at the time of the survey. And consistent with those findings is the recent increase in multiple job offers for experimentalists by three percentage-points, whereas multiple offers for theoreticians decreased by eight percentage-points in the most recent year.

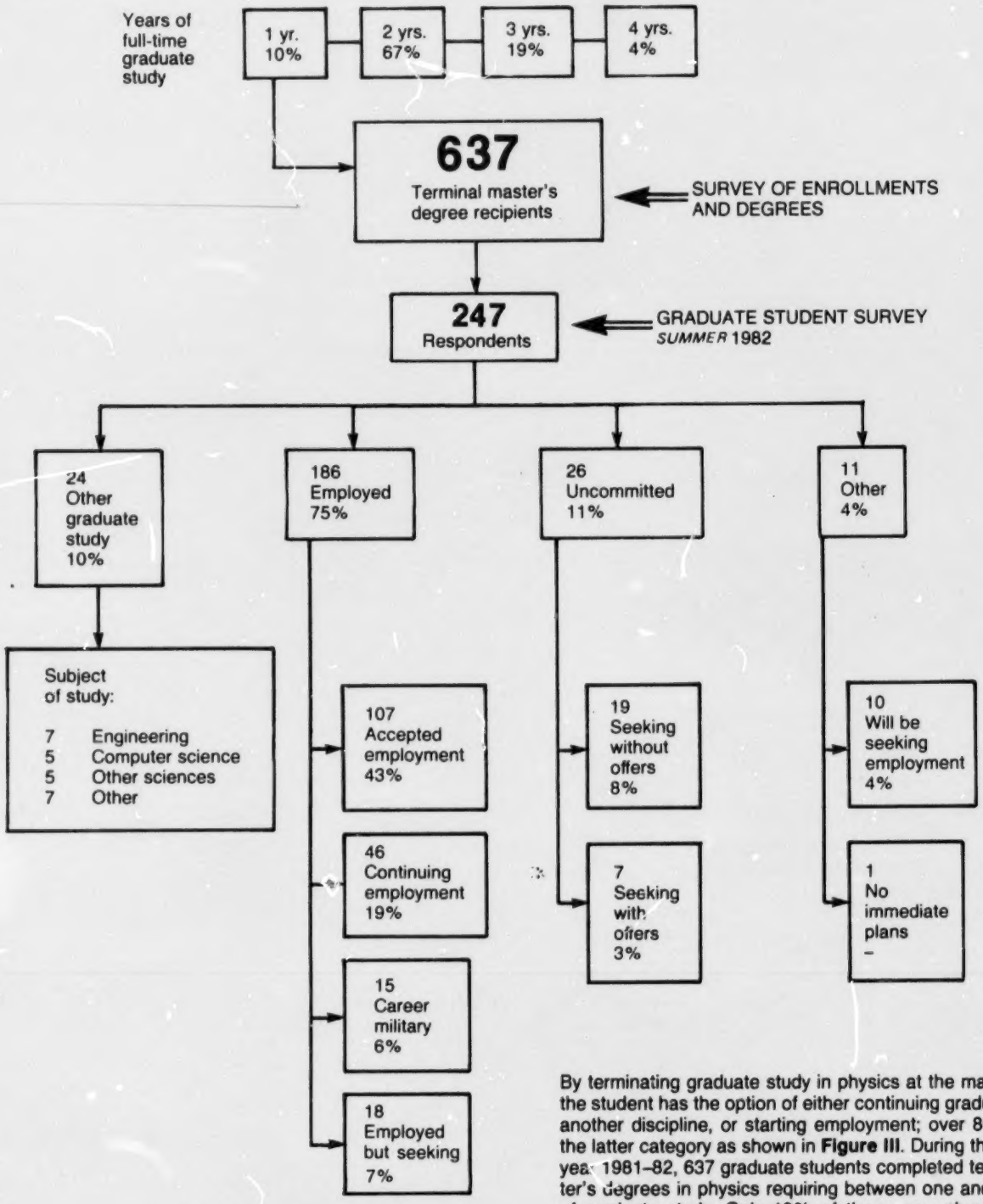
In view of the rapid increase in foreign graduate physics students, it is important to examine the initial employment plans of current graduating classes to form a basis for future comparisons in the mid 1980's when the proportion of foreign graduates will be much larger. A certain fraction of foreign graduates has always returned to their native countries upon completing physics doctorates in the United States, but it is unclear at this time to what extent this fraction will increase, and what legislation will be in effect for those foreign degree recipients who will want to remain in the U.S.

Table VII divides the graduates on the basis of citizenship and shows that larger proportions of foreign graduates (1) accept temporary 'postdocs' and (2) are uncommitted. In 1982 one quarter of the foreign graduates reported foreign employers for their initial employment, and it is that fraction which may change significantly in three to five years.

Table VII. Employment of doctoral graduates by citizenship, 1981–82.

Doctoral graduates		U. S. employer 'Postdoc'	U. S. employer Accepted	U. S. employer Cont.	Foreign employer 'Postdoc'	Foreign employer Accepted	Uncommitted	Total N	Total %
U.S. citizens		159	179	35	13	6	25	417	75
Foreign citizens		58	26	9	10	27	11	141	25
Total	N	217	205	44	23	33	36	558	
	%	39	37	8	4	6	6		100

Figure. III. Post-degree plans of physics terminal master's degree recipients, 1981–82.



By terminating graduate study in physics at the master's level, the student has the option of either continuing graduate work in another discipline, or starting employment; over 80% fall into the latter category as shown in **Figure III**. During the academic year 1981–82, 637 graduate students completed terminal master's degrees in physics requiring between one and four years of graduate study. Only 10% of those new physics masters were able to complete their degrees in one year. The majority of new masters who transfer to "other graduate study" usually choose an area closely related to physics, and the 1982 graduates follow that trend.

Table VIII. Distribution by subfield of employment offers for terminal masters, 1981–82.

Physics subfield	Total in subfield*	Percentage of graduates: within subfield received: 0 offer	1 offer	>2 offers
Biophysics/radiology	6.2%	8%	67%	25%
Engr. and applied physics	13.2	13	67	20
Geo. space physics	9.7	7	67	26
Optics	7.8	–	67	33
Plasmas, fluids	3.7	–	67	33
Solid state	19.3	11	46	43
General physics	13.2	7	64	29
All other subfields	26.9	21	56	23
Total	100.0%	11%	60%	29%
Employment-oriented respondents		23	127	62

*Based on 247 respondents.

Judging from the proportion of degree recipients who classify themselves as "seeking (employment) without offers," the demand for new physics masters must have increased somewhat from the previous year. On the other hand, terminal master's degree candidates include a large proportion of part-time students who are employed while they complete their degrees; it is that group which is shown in **Figure III** as "continuing employment," and presumably these graduates did not consider themselves in the 1982 job market. Graduates whom we classify as "employed but seeking," were also, by and large, part-time graduate students, but whose employment probably did not utilize their graduate physics training, so that their newly-acquired master's degrees prompt them to seek more challenging work. The size of the group of new masters who reports postponing its entry into the job market, remained at 4%, and seven out of those ten graduates are U.S. citizens.

To offer greater detail on the "employed" and "uncommitted" groups of **Figure III**, we constructed **Table VIII** which relates employment offers to the subfields those masters pursued in graduate school. Less than one-third of the new masters reported multiple offers from employers, and that is an eleven percentage-point decline from the previous year. In 1982 solid state physicists appear to include a disproportionately large percentage of graduates who reported two or more job offers, but in absolute terms, that 43% is identical to the previous year's percentage. Examining the distribution of subfields in **Table VIII**, we note gains of four and five percentage-points over the previous year in biophysics and engineering physics respectively.

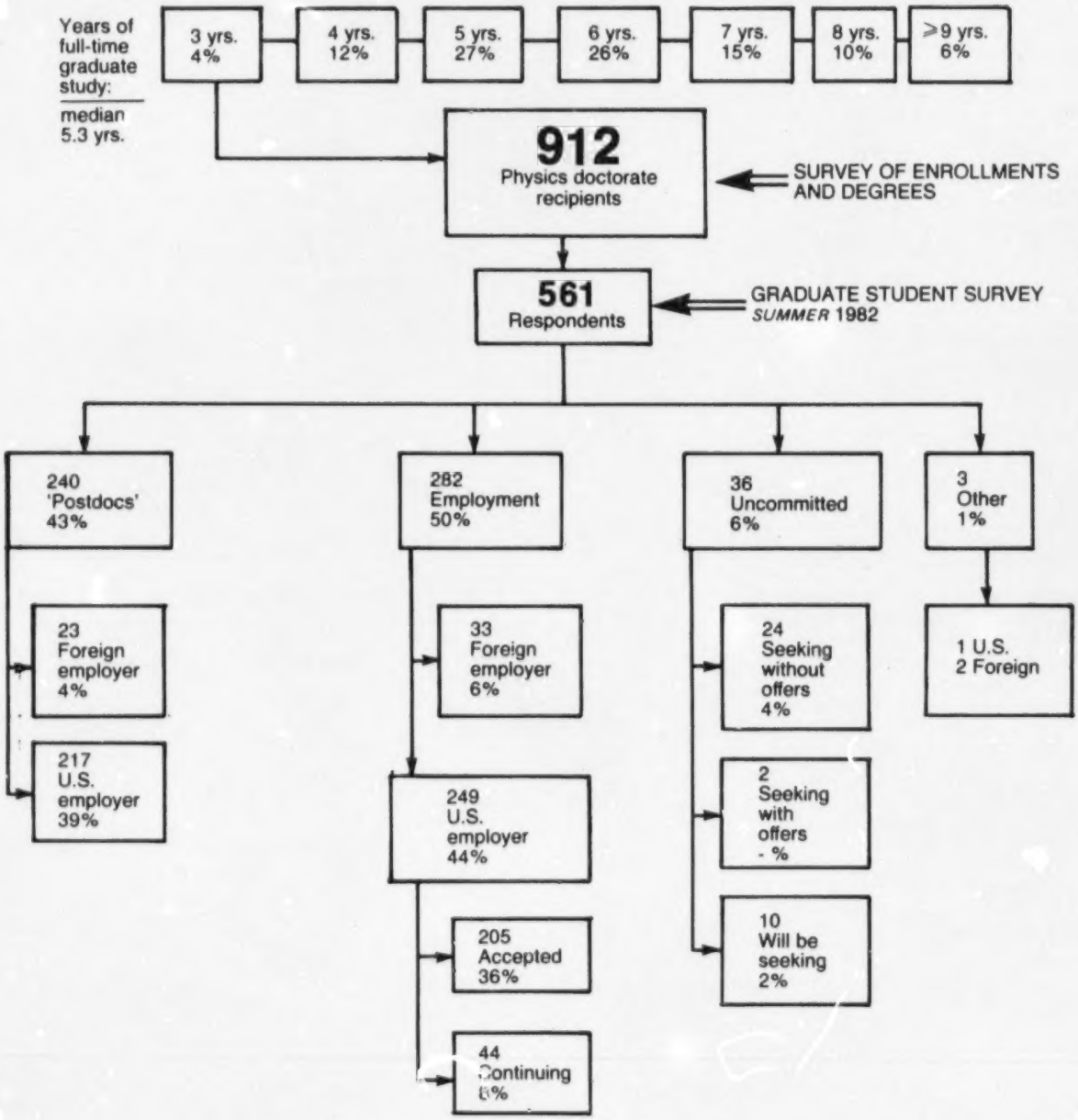
There is a tendency on the part of graduates to start their employment before completing the questionnaires we sent them; hence the great majority of them are able to specify their type of employer and work activity. **Table IX** presents this information on 177 master's degree recipients. As expected, industry is the largest single employer which engaged 43% of all respondents in research, development or engineering work activities. When compared with the previous year, few graduates work as programmers which is consistent with the increase in the proportion of masters who make extensive use of their training. The number of new physics masters attracted to secondary school teaching positions appear to be at a record low; it comprises 2% of the respondents. One and two years earlier the corresponding percentages were three and five respectively.

Table IX. Employment characteristics of 1981–82 recipients of master's degrees.

Work activity		Sec. school	Coll.	Univ.	Industry	Gov't inc.mil.	Other	Total N	Total %
Teaching		4	10	8	1	2	–	25	14
Research		–	2	4	10	6	1	23	13
Res. and dev.		–	–	1	34	12	6	53	30
Engineering		–	–	–	42	9	–	51	29
Programming		–	–	1	4	1	–	6	3
Nonphysics prof'l		–	–	–	5	2	2	9	5
Other		–	–	–	2	5	3	10	6
Total	N	4	12	14	98	37	12	177*	
	%	2	7	8	55	21	7		100%

*Nine additional masters did not report employers and work activities. Ten masters, included among the 177, returned to their native countries to start employment.

Figure IV. Background characteristics and post-doctorate status of 1981–82 physics graduates.



The flow diagram of **Figure IV** presents an overall picture of the physics doctorate recipients for 1981–82. Although the median number of years required to complete a physics doctorate rose only by a small fraction, the percentage of graduates who took eight years or longer increased from twelve to sixteen percent in the most recent year.

Where post-doctorate commitments are concerned, **Figure IV** divides those into four broad categories with a further division which distinguishes between U.S. and foreign employers. **Table VII** goes into greater detail concerning the citizenship of the employed, but **Figure IV** aims at providing a frame of reference in which to evaluate the proportion of doctoral graduates who were still uncommitted.

Table X. Use of physics in potentially permanent employment of graduate degree recipients, 1981–82.

	Major employer	Extensive use of physics training with respect to: method	subject matter	Number responding to question
Doctorate recipients	University	80%	83%	47
	College	90	83	12
	Industry	78	63	127
	FFRC	91	76	21
	Government	87	57	30
	Total	81%	68%	243

		Use of physics training with respect to subject matter: Extensive	Little	None	Number reporting
Terminal masters	Educational inst.	73%	19%	8%	26
	Industry	43	50	7	82
	FFRC/Gov't	69	28	3	29
	Total	56%	37%	7%	137

Since underemployment has always been a concern, graduates are asked to evaluate their initial employment in terms of the use they are making of their training. **Table X** summarizes the answers from both doctoral and master's graduates whose initial employment is potentially permanent. Distinguishing between utilizing research methods and subject matter is primarily meaningful where doctoral physicists are concerned, and, when reported in relation to major employers, more industrial and government physicists are using their research methods than their subject matter extensively. Terminal masters need to find employment in educational institutions or the government to be assured of extensive use of their physics training. A majority of those employed in industry report making little or no use of their training in terms of subject matter.

Table XI excludes 'postdocs' and relates the major employers to work activities for physics doctorate recipients. With guarded optimism we note the recent increase in tenurable positions at universities. Among the 1981 graduates, similar in size to those presented in **Table XI**, only 6.6% reported tenurable university positions; for the 1982 degree recipients, that percentage rose to eleven. And examining the work activities, the combination of research and teaching appears to have gained six percentage-points over the previous year; however, teaching or research reported as single work activities remained almost constant.

Table XI. Initial employment with potential permanence for 1981–82 physics doctorate recipients

Work activity		Type of employer: University Tenurable	University Non-tenurable	College	Industry	FFRC	Gov't	Other	Total N	Total %
Teaching		6	3	6	–	–	1	–	16	6
Research		1	10	–	29	14	11	3	68	26
Res. and teaching		21	7	7	–	–	–	1	36	14
Res. and dev.		1	2	–	74	3	16	1	97	37
Engineering		–	1	–	21	2	3	–	27	10
Other		–	1	–	10	2	3	2	18	7
Total	N	29	24	13	134	21	34	7	262	
	%	11	9	5	51	8	13	3		100%

Table XII. Median monthly salaries* paid by U.S. employers to new physics graduates, 1981–82.

Type of employer	Bachelor's degree recipients		Terminal master's degree recipients		Doctorate recipients			
	Percentage accepting positions	Monthly starting salaries	Percentage accepting positions	Monthly starting salaries	Percentage accepting: 'Postdocs'	Potentially perm. pos.	Monthly starting salaries for: 'Postdocs'	Potentially perm. pos.
Secondary school	3%	$1050	2%	**	–	–	**	**
College	2	**	7	$1670	–	3%	**	$1650
University	2	1400	8	**	34%	11	$1510	1990
Industry	60	1970	56	2230	3	28	2470	2830
Gov't inc. mil.	29	1370	17	1850	2	7	1850	2350
Fed. Funded Res. Ctr.	2	1850	2	**	5	4	1870	2400
Other	2	**	8	**	2	1	**	**
All employers	100%	$1710	100%	$2140	100%		$1550	$2670

*Salaries shown in this table are based on newly accepted positions.
**Fewer than ten graduates reported salaries.

Starting salaries presented in **Table XII** include only those paid by U.S. employers for newly accepted positions. Hence the 44 physicists shown in **Figure IV** as "continuing" employment held while completing their doctorates, are not included. Doctoral physicists are divided into two groups because those starting potentially permanent employment are paid significantly higher salaries than those who accepted postdoctoral fellowships. For purposes of comparison, the starting salaries of physics bachelors were included in **Table XII** although they are not collected as part of the Graduate Student Survey. Thus the four salaries shown for the three levels of physics degrees place 'postdocs' and regularly-employed doctoral physicists at opposite ends of the salary scale. Their 1982 starting salaries correspond to 6% and 8% increases respectively. The salaries of physics masters registered the largest increase among physics graduates: the median of $2140.— corresponds to a 12% increase over the previous year. Bachelors' salaries rose only 3%. Industry generally pays the highest salaries, and even when sponsoring postdoctoral fellowships, industrial employers offer them at 60% above the median.

ASTRONOMY

Now in its eighth year, the Survey of Graduate Astronomy Students analyzes information contributed by 80% of the graduate student population enrolled in almost 50 graduate astronomy departments. The distribution of students by level of graduate study is shown in **Table XIII** which relates those levels to nine major subfields including astrophysics. Almost one-quarter of the graduate students specialize in cosmology which remains the largest subfield. Compared to the previous year the proportion of students enrolled for five or more years has decreased somewhat which is consistent with the slightly lower median time required by the 1982 doctorate recipients to have completed that degree.

Table XIII. Graduate astronomy students* by subfield and years of graduate study, 1981–82.

	Full-time equivalent years of graduate study						Total	
	1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	⩾6 yrs.	N	%
Distribution of students N	142	147	104	78	84	92	647	
Distribution of students %	22%	23%	16%	12%	13%	14%		100%
Astronomy subfields								
Astronomical instruments and techniques	9%	5%	5%	9%	–	1%	32	5
Cosmology, extragalactic objects, quasi-stellar objects	20	18	33	19	25	32	155	24
Galactic structure, stellar motions	9	8	12	12	4	6	52	8
Interstellar matter and gaseous nebulae	11	16	13	13	16	15	91	14
Solar system, space astronomy of the solar system	9	12	5	6	11	9	58	9
Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors	16	15	12	16	24	26	116	18
Supernovae, X, γ and cosmic rays, pulsars	1	2	3	9	4	4	26	4
The Sun	3	2	3	2	4	3	19	3
Astrophysics	11	13	9	10	7	1	58	9
All other subfields combined	11	9	5	4	5	3	40	6
	100%	100%	100%	100%	100%	100%		100%

*The percentages shown in this table are based on 509 respondents to the Graduate Student Survey. Astronomy department chairmen reported a total of 647 graduate students for the Survey of Enrollments and Degrees.

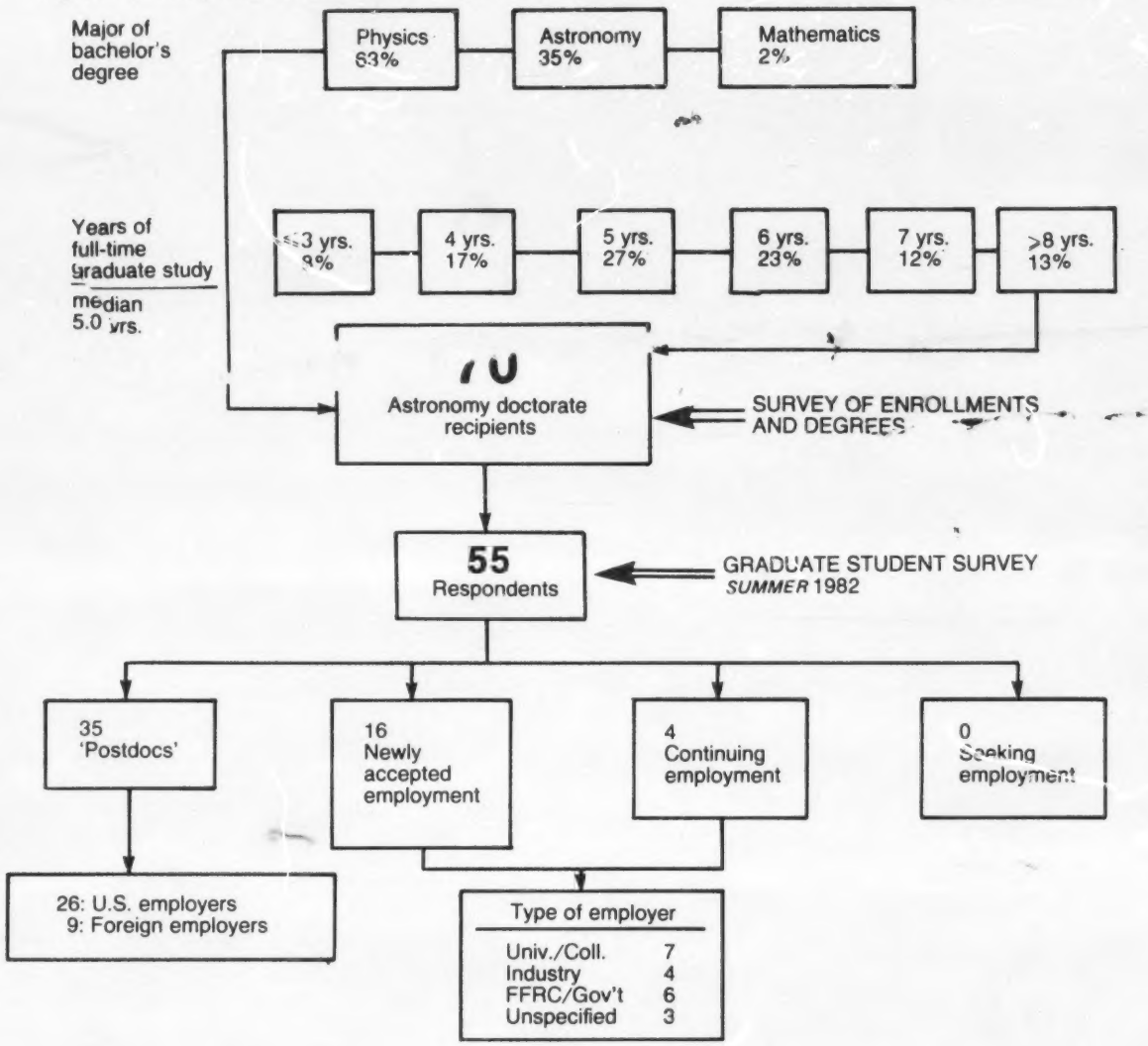
The first two rows of **Table XIV** indicate not only the size of the graduate astronomy student body and that of three subgroups, but also the high response rate by them to this survey. The table lists eight characteristics of these four groups and includes, for the first time, membership in the American Astronomical Society (AAS). As one might expect, few first-year graduate students are AAS members, but where doctorate recipients are concerned, almost two-thirds of them report membership. Unlike physics, the graduate astronomy student population does not experience an influx of foreign students, and the proportion of women among the first-year students has doubled in the most recent year. Another characteristic which shows a change worth noting, is "type of bachelor's institution." For the first-year graduate students the proportion of students who came from four-year colleges appears to have doubled; **Table XIV** shows this proportion to be 29%, whereas 13% to 17% was the range in previous years.

Table XIV. Characteristics of the graduate astronomy student population, 1981–82.

Characteristics		All graduate students	First-year graduate students	Degree recipients: Terminal masters	Degree recipients: Doctorate recipients
	*Total population:	647	142	15	70
	Number of respondents	522	91	12	55
Sex	Female	14%	24%	9%	16%
	Male	86	76	91	84
Citizenship	U.S.	86%	87%	92%	93%
	Foreign	14	13	8	7
Membership in a prof'l society	AAS	33%	13%	–	64%
	Other	6	3	–	9
	None	47	66	58	18
	No response	14	18	42	9
Major of bachelor's degree	Astronomy	35%	37%	33%	35%
	Physics	54	52	42	63
	Mathematics	5	4	–	2
	Other	6	7	25	–
Type of bachelor's institution	PhD-granting	66%	55%	82%	61%
	MS-granting	7	14	–	7
	BS/BA-granting	16	29	9	25
	Foreign	11	2	9	7
*Type of graduate institution	PhD-granting	96%	92%	80%	100%
	MS-granting	4	8	20	–
Student status	Full-time	95%	97%	72%	90%
	Part-time	5	3	28	10
Source of support	Teaching assist.	33%	56%	25%	14%
	Research assist.	42	18	25	45
	Fellowship	13	19	8	12
	Employment	6	3	25	18
	Other	6	4	17	11

These data were reported by astronomy department chairmen as part of the Survey of Enrollments and Degrees.

Figure V. Background characteristics and post-doctorate status of 1981–82 astronomy graduates.



The new doctoral astronomers are singled out in **Figure V** in order to focus on their employment status. For the second successive year each respondent had either secured a 'postdoc' or potentially permanent employment. To illustrate this finding, **Figure V** includes a zero in the box labeled "seeking employment." As in past years, a majority of new astronomers accepted 'postdocs', and, though not shown in the flow diagram that statement holds true for the small number of women graduates. There were 9 women among the 55 degree recipients and five of them accepted 'postdocs'. As referred to in the characteristics table the doctorate recipients include four foreign citizens, three of whom accepted 'postdocs' outside the United States.